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# REPORT

ON THE

## QUALITY OF THE MILK SUPPLY

OF THE

### METROPOLITAN DISTRICT.

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*Charles*  
BY  
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# REPORT ON THE QUALITY OF THE MILK-SUPPLY DURING THE YEAR 1869.

COLONEL EMMONS CLARK, *Secretary of the Metropolitan Board of Health.*

SIR: The investigations with regard to the quality of the milk-supply in the Metropolitan District, which were undertaken at the suggestion of Dr. Harris, the Sanitary Superintendent, have been continued during the past year, and I announce with great satisfaction that thus far no adulterant has been detected except water.

## I.—PURE MILK.

Milk consists of water holding *in solution* casein or cheese, lactine or sugar of milk, and various alkaline and earthy salts; and *in suspension*, fatty matter, butter, in the form of myriads of semi-opaque globules, to which the color and opacity of milk are due.

### 1. *The Average Composition of Pure Milk, according to Dr. Letheby, is:*

Water .....	86.00
Butter .....	3.90
Casein .....	4.10
Sugar. ....	5.20
Salts.....	0.80
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	100.00

### 2. *Complete Analysis of Milk by Haidlen.*

Water .....	87.30
Butter .....	3.00
Casein .....	4.82
Sugar .....	4.39
Phosphate of Lime .....	0.230
Phosphate of Magnesia.....	0.042
Phosphate of Iron.....	0.007
Chloride of Potassium.....	0.144
Chloride of Sodium.....	0.024
Soda, combined with Casein.....	0.042
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	100.00

The specific gravity varies from 1.023 to 1.032, pure water being 1.000  
The reaction is generally faintly alkaline.

The composition of milk is, however, affected by a variety of circumstances,

as the breed of the cow, her age, the age of her calf, nature of her food, time of milking, frequency of milking; and it is even found that the last milk which comes down at a milking is richer in butter than that which is first drawn. This last-mentioned fact shows that the custom which prevails in some localities of driving the cow from house to house, and supplying the consumer with milk fresh from the udders is not quite equitable, as the last person supplied receives a richer milk than is given to the first customer.

The following analyses illustrate these statements:

3. *Milk from Different Breeds of Cows. Analyses by Vernois et Becquerel.*

Breed.	Water.	Butter.	Casein.	Sugar.	Salts.
Angus.....	80.32	9.88	5.28	3.73	0.72
Belgian—Durham.....	85.77	6.22	4.06	3.29	0.67
Bohemian.....	84.18	6.34	3.87	4.96	0.64
Bretonne.....	83.74	5.70	5.37	4.55	0.62
Charollais.....	85.28	6.42	4.12	3.49	0.68
Durham, two analyses.....	84.56	6.41	4.37	3.97	0.68
Flamande.....	88.30	3.72	3.37	4.03	0.54
Dutch, three analyses.....	83.97	6.84	4.21	4.35	0.61
Murzthal.....	85.31	6.28	3.14	4.62	0.64
Normandy.....	87.18	3.24	4.76	4.21	0.60
Paris, thirty analyses.....	86.40	3.61	5.21	4.10	0.66
Swiss.....	85.19	7.08	2.55	4.59	0.56
Tyrol.....	81.74	7.96	4.95	4.82	0.50
Voigtland.....	84.99	5.14	4.56	4.62	0.68
Average, 46 analyses.....	85.76	4.51	4.86	4.15	0.65

4. *Effect of Food on the Quality of Milk. Analyses by Chevalier.*

	Carrots.	Beets.
Water .....	86.67	86.87
Butter .....	3.08	2.75
Casein.....	4.20	3.75
Sugar.....	5.30	5.95
Salts .....	0.75	0.68
	100.00	100.00

5. *Difference in Morning and Evening Milk. Averages of many Analyses by Alex. Müller.*

	Morning.	Evening.
Water .....	87.43	86.87
Butter.....	3.77	4.32
Casein .....	3.40	3.44
Sugar.....	4.67	4.66
Salts .....	0.73	0.71
	100.00	100.00

*Methods of Analysis.*

1. The water is determined by evaporating a weighed quantity of milk, either alone or soaked up in a known weight of pure, fine quartz sand. The residue is carefully dried at 212° F., and weighed. The loss in weight represents the water, while the residue includes all the solid constituents.

2. The salts are determined by carefully burning off the combustible portion

of the solid residue obtained by evaporation, and weighing the incombustible ash.

3. The butter and casein are determined by coagulating the milk with a few drops of acetic acid, boiling, washing the precipitate with water, and finally separating the butter with ether, leaving the casein pure. On evaporating the ether, the butter is left behind, or the butter may be extracted by ether from the residue obtained by the evaporation of a quantity of milk, soaked up in sand.

4. The sugar is generally determined by deducting the sum of the other constituents from 100. It may be directly determined by the polariscope, after the removal of the casein and butter, or it may be determined by an alkaline solution of copper.

## II.—THE ADULTERATION OF MILK.

Numerous substances are mentioned as having been used, or as supposed to be used, for adulterating milk. Prominent among these are :

1. *Water*.—Adulteration with this substance is generally detected by the specific gravity of the milk. Pure milk varies in specific gravity from 1.023 to 1.034, water being represented by 1.000. Milk is heavier than water, on account of the casein, sugar, and salts, which it holds in solution. Butter, on the other hand, is lighter than water, therefore the specific gravity of milk increases with the percentage of casein, sugar, and salts, while it diminishes with the percentages of water or butter. It is found that good milk generally has a specific gravity of from 1.029 to 1.032. In testing milk the lower number is selected as a fair gravity for pure milk; and whenever the gravity falls below this number the milk may be considered as containing an excess of water, and consequently poor in quality or adulterated. An instrument, called a galactometer, has been devised by Dinocourt, for the purpose of testing the quality of milk. It is simply an areometer, so graduated that 100 on the scale represents pure milk, or the gravity 1.029, while 0 represents pure water or gravity 1.000, the space between being divided into 100 parts. The numbers on the scale represent, therefore, the percentages of pure milk.

Skimmed milk, having been deprived of most of its butter, is heavier than whole milk. By skimming the milk before testing it with the galactometer, the error caused by the butter is eliminated. In this case, however, the mark for 100, or pure milk, must be placed lower down on the instrument, as pure milk, having a specific gravity of 1.029, would after being skimmed, have a gravity of about 1.033. The 100° mark for skimmed milk is, therefore, fixed at this point.

The *lactometer* is a simple tube closed at the lower end, and graduated in hundredths. It is designed to measure the quantity of cream which rises on the milk.

By using the two instruments together, the *galactometer* and the *lactometer*, very satisfactory conclusions with regard to the quality of milk can be formed. A perfectly reliable method, though more laborious, is to actually determine the percentage of water in the milk, by evaporating a weighed quantity, and carefully drying the residue at 212° F. If a milk loses more than 88 per cent. of

water, having less than 12 per cent. of solids, it may be safely pronounced to be adulterated with water.

2. *Chalk*.—This substance is generally supposed to be extensively used to neutralize the acidity in soured milk, and to produce thickness and opacity, thus concealing dilution with water. It is easily detected, as it is deposited on standing, and can then be recognized by its effervescing with dilute acids. I have never detected it in any sample of milk examined. Its presence would also be shown in a milk analysis, by the unusual amount of ash.

3. *Flour, starch, emulsions of almonds, or hemp-seed, etc.*, are said to be used to thicken milk, and neutralize the blue color caused by dilution. They were not found in any of our samples.

4. *Sugar, gum, dextrin and borax*, to increase specific gravity.

5. *Turmeric and annatto*, to hide the blue color.

6. *Cerebral matter, sheep's brains*, to thicken watered milk, easily detected by the microscope, and by its depositing a peculiar white sediment on standing.

7. *Carbonate or bicarbonate of soda*, to neutralize acidity. Detected by the increase in the quantity of ash, or better by the effervescence of the ash with acids.

### III.—THE MILK SUPPLIED TO CONSUMERS IN THE METROPOLITAN DISTRICT

Two hundred and ninety-seven specimens of the milk supplied to consumers in the Metropolitan District have been submitted to chemical examination. Of these forty-five were seized while undergoing the process of dilution with water, two hundred and forty-five were purchased from the retail dealers, and seven were procured at one of the crowded cow-stables in Brooklyn.

*First Series of Analyses*.—In the latter part of February, some milkmen were detected in the act of pouring a suspicious fluid, contained in milk-cans, into their milk. They were at once arrested, and taken, with their cans, about fifty in number, to police headquarters. Samples from forty-five of the cans, which were placed in my hands for examination, gave the following results:

Two cans contained water, not any too pure.

Two cans contained water, clouded with a little milk, probably from having been pumped into cans which had contained milk.

Four cans contained water to which considerable milk had been added, the specific gravity varying from 1.010 to 1.017, representing by the galactometer from 37 to 60 per cent. of milk.

Nineteen cans contained milk, to which considerable water had been added, the specific gravity varying from 1.023 to 1.028, representing from 80 to 97 per cent. of milk.

Eighteen cans contained pure milk, varying in specific gravity from 1.029 to 1.030.

None of the samples contained any adulterant save water. The large proportion of pure milk is accounted for by the fact that the work of dilution was interrupted by the police.

*Second Series of Analyses*.—During the months of June and July a systematic examination of milk was organized, the samples being purchased from re-



tail dealers in various portions of the Metropolitan District. Two hundred and ten samples were analyzed, the following determinations being made in each case :

1. The specific gravity.
2. The percentage of pure milk as shown by the galactometer.
3. The percentage of water.
4. The percentage of solid matter, including butter, casein, sugar of milk, saline constituents, etc.
5. Examination for adulterations.

The results are herewith presented in tabular form, and from them we learn the following facts :

1. The specific gravity varies from 1.010 to 1.032, averaging 1.0208.
2. The percentage of pure milk, as shown by the galactometer, ranges from 37 to 110, averaging 72½.
3. The percentage of water varies from 83.57 to 94.17, averaging 89.89.
4. The percentage of solid constituents, the nutritive portion of the milk, varies from 5.83 to 16.43 per cent., averaging 10.11
5. No adulteration was found in a single instance, save water.

Table I.—Milk Examinations during June and July, 1869.

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
— McSwyny.....	497 Pearl Street.....			87.79	12.21
D. & A. Boseke.....	14 Franklin.....	1.029	98	90.14	9.86
Chas. Doscher.....	61 Baxter.....	1.029	98	82.42	17.58
	13 Mott.....	1.032	106	88.80	11.10
	71 Park Place.....	1.029	98	88.12	11.88
Wm. Moller & Son.....	524 Pearl.....	1.020	70	91.18	8.82
C. A. Emmet.....	21 Mott.....	1.025	86	89.68	10.32
Daniel Sullivan.....	67 Park Street.....	1.025	86	88.33	11.67
D. Driscoll.....	24 City Hall Place.....	1.020	70	89.00	11.00
Mrs. Horsey.....	136 Leonard.....	1.020	70	88.11	11.89
Gallighan Bros.....	119 Mulberry.....	1.025	86	87.84	12.16
J. J. Geaby.....	22 Mulberry.....	1.025	86	89.41	10.59
Schneider & Wilken.....	115 Baxter.....	1.025	86	86.17	13.83
J. Dellart.....	40 Eldridge.....	1.025	86	85.22	14.78
J. Seeldy.....	36 Park.....	1.022	76	86.71	13.29
— McSwyny.....	497 Pearl.....	1.022	76	82.97	17.03
A. Knauer.....	79 Broome.....	1.025	86	88.72	11.28
C. W. Dainty.....	234 Worth.....	1.025	86	88.38	11.62
H. Pentz.....	119 Baxter.....	1.025	86	89.41	10.59
A. Horr.....	263 Rivington.....	1.020	70	90.09	9.91
J. F. McDowell.....	92 Henry.....	1.026	90	87.72	12.28
F. McKenne.....	34 Pitt.....	1.025	86	90.15	9.85
J. McKulloch.....	Laurel Hill.....	1.018	63	90.81	9.19
G. Kasselmine.....	72 Garrick.....	1.020	70	88.26	11.74
J. McDonald.....	103 Broome.....	1.022	76	88.76	11.24
A. Schullingburg.....	169 Allen.....	1.025	86	89.01	10.99
J. Wittman.....	131 E. Houston.....	1.026	90	88.42	11.58
J. Watjen.....	34 2d Avenue.....	1.020	70	89.11	10.89
W. Doyle.....	79 Ludlow.....	1.025	86	90.89	9.11
G. Bachmann.....	51 Ludlow.....	1.020	70	88.85	11.15
J. Raedig.....	106 Allen.....	1.023	80	89.51	10.49
J. M. Oest & Co.....	16 2d Avenue.....	1.023	80	89.12	10.88
Peter Fick.....	230 6th Avenue.....	1.025	86	85.55	14.45
D. F. Reck.....	113 W. 10th.....	1.025	86	87.79	12.21
F. H. Rohers.....	58 6th Avenue.....	1.025	86	87.81	12.29
H. Piefke.....	18 6th Avenue.....	1.025	86	88.78	11.22
N. Bremer.....	4 6th Avenue.....	1.027	93	88.36	11.64
D. Hopmann.....	22 Minetta Lane.....	1.022	76	89.89	10.11

## Milk Examinations—(Continued).

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
Wm. Rame.....	26th Street and 7th Avenue..	1.027	93	89.26	10.74
A. Lieberg.....	257 7th Avenue.....	1.025	86	87.93	12.07
Russing & Elbert.....	189 7th Avenue.....			87.43	12.57
J. McCrady.....	1344 7th Avenue.....	1.025	86	87.46	12.54
Wm. J. Acker.....	21 7th Avenue.....	1.025	86	88.28	11.72
R. Devans.....	37 Greenwich Avenue.....	1.025	86	88.43	11.57
P. Steinmann.....	105 11th Avenue.....	1.028	96	87.63	12.37
J. W. Steinbeck.....	63d Street and 2d Avenue....	1.025	86	87.57	12.43
Block & Co.....	337 54th Street.....	1.024	83	88.42	11.58
Hermann & Son.....	1024 2d Avenue.....	1.022	76	89.18	10.82
— Cunningham.....	1008 2d Avenue.....	1.020	70	89.27	10.73
C. M. Cornell.....	Astoria.....	1.020	70	90.14	9.86
— Futhius.....	223 E. 53d Street.....	1.023	80	90.37	9.63
P. Brady.....	45th Street and Madison Ave.	1.027	93	86.27	13.73
— McNeal.....	46th Street and 4th Avenue..	1.025	86	83.57	16.43
H. Hallan.....	338 E. 58th Street.....	1.020	70	88.90	11.10
E. Thomas.....	207 E. 36th Street.....	1.025	86	87.22	12.78
P. Mallach.....	589 2d Avenue.....	1.024	83	87.78	12.22
M. Snider.....	61st Street near 2d Avenue....	1.012	44		
G. Hammer.....	57th Street near 5th Avenue..	1.025	86		
J. B. Murry.....	813 7th Avenue.....	1.020	70	88.27	11.73
B. Schwietering.....	57th Street and 7th Avenue..	1.023	80	88.90	11.10
— Mills.....	790 7th Avenue.....	1.025	86	88.64	11.36
— Dillinger.....	412 W. 50th Street.....	1.027	93	88.64	11.36
J. Bohde.....	824 2d Avenue.....	1.025	86	89.60	10.40
C. H. Steinkamm.....	863 2d Avenue.....	1.023	80	88.10	11.90
F. Buse.....	765 2d Avenue.....	1.020	70	90.25	9.75
Powell & Co.....	681 2d Avenue.....	1.022	76	89.62	10.38
H. Claussen.....	648 2d Avenue.....	1.027	93	88.74	11.26
F. Kriete.....	82 7th Avenue.....	1.019	66	91.25	8.75
Bussing & Elbert.....	189 7th Avenue.....	1.022	76	88.98	11.02
P. L. Hulle.....	721 9th Avenue.....	1.020	70	90.85	9.15
P. Brahnburg.....	683 9th Avenue.....	1.023	80	89.36	10.64
— Bucklage.....	628 9th Avenue.....	1.018	63	90.02	9.98
— Maxwell.....	558 9th Avenue.....	1.018	63	90.82	9.18
J. Bernhard.....	469 9th Avenue.....	1.025	86	88.47	11.53
R. Doty.....	315 9th Avenue.....	1.018	63	92.04	7.96
Browning & Berry.....	183 9th Avenue.....	1.025	86	88.33	11.67
Wessel & Puckley.....	2 9th Avenue.....	1.025	86	88.79	11.21
H. H. Krogan.....	518 10th Avenue.....	1.020	70	89.73	10.27
— Fight.....	500 10th Avenue.....	1.012	44	93.25	6.75
M. Schried.....	368 10th Avenue.....	1.017	60	90.22	9.78
D. Hunkey.....	327 10th Avenue.....	1.018	63	90.70	9.30
E. Ryan.....	263 10th Avenue.....	1.018	63	91.00	9.00
— Hunker.....	242 10th Avenue.....	1.023	80	91.54	8.46
J. O. Sullivan.....	153 10th Avenue.....	1.013	47	92.26	7.74
J. Ruter.....	770 Greenwich.....	1.014	50	91.41	8.59
P. Hohre.....	744 11th Avenue.....	1.015	53	92.32	7.68
— Murray.....	673 4th Avenue.....	1.021	73	91.07	8.93
P. Swick.....	609 10th Avenue.....	1.017	60	91.16	8.84
— Plunkett.....	517 10th Avenue.....	1.031	103	85.47	14.53
A. Marquart.....	422 10th Avenue.....	1.014	83	90.22	9.78
P. O. Sullivan.....	153 10th Avenue.....	1.015	53	92.39	7.61
Austin Yearsks.....	118 9th Avenue.....	1.022	76	89.92	10.08
F. Panaxtre.....	160 8th Avenue.....	1.016	56	91.61	8.39
John Maurer.....	997 1st Avenue.....	1.023	80	89.73	10.27
H. Berns.....	839 1st Avenue.....	1.021	73	91.02	8.98
H. Rick.....	815 1st Avenue.....	1.017	60	91.47	8.53
C. H. Katter.....	547 1st Avenue.....	1.016	56	91.99	8.01
H. D. Bruns.....	445 1st Avenue.....	1.020	70	91.36	8.64
P. D. Cordes.....	429 1st Avenue.....	1.017	60	90.58	9.42
John M. Oest.....	383 1st Avenue.....	1.020	70	90.60	9.40
F. Purdy.....	319 1st Avenue.....	1.020	70	90.21	9.79
John Spielmann.....	222 1st Avenue.....	1.015	53	91.64	8.36
— Oppenheimer.....	201 1st Avenue.....	1.020	70	90.29	9.71
Henry Klenke.....	146 1st Avenue.....	1.020	70	90.43	9.57
D. Klenke.....	115 1st Avenue.....	1.019	66	90.54	9.46
A. Schulz.....	96 1st Avenue.....	1.023	80	90.70	9.30
David Roemer.....	60 1st Avenue.....	1.015	53	91.72	8.28
Henry Malsey.....	26 1st Avenue.....	1.015	53	92.09	7.91
A. Schulte.....	11 1st Avenue.....	1.018	63	90.80	9.20
John Thiel.....	207 Avenue A.....	1.015	53	91.93	8.07
Chas. Mincum.....	147 Avenue A.....	1.017	60	91.20	8.80
F. Ebenger.....	149 Avenue A.....	1.015	53	92.03	7.97
John Hoopner.....	41 Avenue A.....	1.018	63	93.08	6.92

## Milk Examinations—(Continued).

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc., Dried at 212° F.
H. & P. Theil	22 Avenue A.	1.012	44	92.61	7.39
Mrs. Surman	175 Suffolk.	1.018	63	91.14	8.86
Henry Bartell	16 Suffolk.	1.020	70	90.70	9.30
Behrl	166 Avenue B.	1.014	50	92.26	7.74
Meyer & Co.	64 Avenue B.	1.018	63	91.48	8.52
Corkersburg.	64 Avenue B.	1.020	70	89.70	10.30
Christ Siles	32 Avenue B.	1.015	53	92.77	7.23
Peter Baker	11 Avenue B.	1.020	70	92.76	7.24
P. Ahleim	203 Avenue C.	1.014	50	92.60	7.40
John Ricken	174 Avenue C.	1.014	50	92.92	7.08
	107 Avenue C.	1.015	53	91.46	8.54
Riese & Brother	69 Avenue C.	1.015	53	92.04	7.96
Will. Barkler	14 Avenue C.	1.015	53	92.31	7.69
J. Cabbenger	6 Avenue C.	1.012	44	94.17	5.83
John Holsten	79 Pitt.	1.015	53	93.43	6.57
Peter Kooney	54 Pitt.	1.015	53	91.80	8.20
H. Kinkan	74 Avenue D.	1.015	53	91.80	8.20
F. Brohel	22 Avenue D.	1.015	53	92.35	7.65
A. Moeller	16 Avenue D.	1.010	37	93.41	6.59
P. Schmidt	101 Columbia.	1.013	47	91.85	8.15
Otto H. Coop.	74 Columbia.	1.020	70	88.98	11.02
Will. Katzin	365 3d Avenue.	1.010	37	93.03	6.97
H. Deveder	345 3d Avenue.	1.012	44	93.08	6.92
L. Balor	415 3d Avenue.	1.013	47	92.29	7.71
C. Fisher	478 3d Avenue.	1.015	53	90.82	9.18
J. G. Gordes	557 3d Avenue.	1.013	47	91.95	8.05
D. H. Schulz	605 3d Avenue.	1.015	53	91.13	8.87
G. E. Wehmann	40 Franklin	1.015	53	91.00	9.00
H. F. Cordes	39 Elm.	1.019	66	90.35	9.65
H. Tienchen	66 W. Broadway.	1.015	53	91.40	8.60
H. F. Newman	7 Hanson.	1.025	86	89.73	10.27
Ph. Frewing	93 Elm.	1.018	62	89.31	10.69
W. Smith	165 Avenue A.	1.028	96	88.53	11.47
F. Intemann	132 Greenwich.	1.022	76	88.87	11.13
Newrenberg.	1 Lispenard.	1.026	90	89.10	10.90
L. Walker	139 W. Broadway.	1.022	76	90.08	9.92
D. Stoyesand.	97 W. Broadway.	1.026	90	89.10	10.90
Wisschusen.	16 York.	1.022	76	90.08	9.92
John Moss	33 Leonard.	1.025	86	88.80	11.20
J. Balch	132 Greenwich.	1.022	76	90.68	9.32
M. Hertily	26 Rector.	1.024	83	89.32	10.68
J. P. Koplie	145 Greenwich.	1.025	86	88.00	12.00
C. Maerbeck	135 Liberty.	1.024	83	88.63	11.37
P. Flynn	151 Washington	1.025	86	88.02	11.98
G. F. Broggensen	91 Greenwich	1.020	70	90.77	9.23
J. McDonald.	19 Albany	1.022	76	89.30	10.70
Wette	Carlisle and Washington.	1.025	86	89.84	10.16
D. McCarthey	8 Morris.	1.020	70	90.33	9.67
K. E. Enright	12 Greenwich.	1.021	73	91.29	8.71
J. H. Gentzen	28 Greenwich.	1.024	83	88.40	11.60
M. Henken	40 Greenwich	1.023	80	87.80	12.20
M. Kelly	4 Morris.	1.016	56	91.54	8.46
Michael Landy	29 Washington	1.020	70	89.87	10.13
Michael O'Connor	71 Washington	1.015	53	91.56	8.44
Philip Shelan	24 Morris.	1.022	76	88.95	11.05
Mrs. Pritchng	401 E. 18th Street.	1.018	63	91.53	8.47
Jaggart.	342 1st Avenue.	1.021	73	88.53	11.47
J. M. Oest	303 1st Avenue.	1.020	70	90.67	9.33
A. Spielmann	220 1st Avenue.	1.020	70	89.84	10.16
C. Wolfart	275 1st Avenue.	1.022	76	89.11	10.89
D. Leopold	402 2d Avenue.	1.025	86	89.74	10.26
A. Kneble	318 E. 22d Street.	1.020	70	89.42	10.58
J. C. Reisen	407 E. 19th Street.	1.018	63	90.01	9.99
L. Remshardt	206 Avenue A.	1.024	83	88.93	11.07
Patrick O'Connor	224 Avenue A.	1.021	73	90.28	9.72
J. Pentar	512 E. 15th Street.	1.023	80	89.18	10.82
J. Haukamp	227 E. 21st Street.	1.024	83	88.97	11.03
E. Wehrenberg	361 2d Avenue	1.020	70	89.53	10.47
P. W. Sanders & Co.	258 Avenue A.	1.024	83	88.07	11.93
C. F. Wilken	273 Avenue A.	1.023	80	89.11	10.89
J. Friede	323 Avenue A.	1.015	53	90.51	9.49
Peter Peterson	231 Avenue B.	1.019	66	90.18	9.82
F. Fippinger	546 E. 11th Street.	1.020	70	89.10	10.90
F. Beek	509 E. 11th Street.	1.018	63	90.47	9.53
F. Ebinger	149 Avenue A.	1.016	56	89.99	10.01

*Milk Examinations—(Continued).*

DEALER.	ADDRESS.	Specific Gravity.	Percentage of Milk by Galactometer.	Percentage of Water by direct Weight.	Total Solids—Butter, Casein, Sugar, etc. Dried at 212° F.
H. Wesemans.....	286 E. 10th Street.....	1.020	70	89.71	10.29
P. Lahr.....	341 E. 10th Street.....	1.023	80	88.45	11.55
H. A. Stegeman.....	352 E. 10th Street.....	1.017	60	90.41	9.59
A. Ritz.....	191 E. 7th Street.....	1.020	70	88.47	11.53
William Reis.....	410 E. 6th Street.....	1.021	73	89.71	10.29
M. Moser.....	433 E. 6th Street.....	1.023	80	89.92	10.08
C. Hartungs.....	437 E. 6th Street.....	1.025	86	89.28	10.72
C. D. Schupp.....	502 E. 6th Street.....	1.023	80	90.07	9.93
Geo. Siemon.....	507 E. 6th Street.....	1.021	73	90.00	10.00
C. Hitzel.....	520 E. 5th Street.....	1.024	83	89.07	10.93
F. Lautenschleuger.....	203 E. 4th Street.....	1.021	73	89.66	10.34
J. Schultz.....	154 E. 4th Street.....	1.024	83	89.48	10.52
J. Henbner.....	41 Avenue A.....	1.021	73	90.21	9.79
Geo. Finkles.....	102 E. 3d Street.....	1.022	76	90.41	9.59
J. Weber.....	193 E. 3d Street.....	1.024	83	88.59	11.41
Chris. Silz.....	32 Avenue B.....	1.023	80	89.79	10.21
L. A. Betsch.....	166 E. 3d Street.....	1.025	86	89.48	10.52
G. Deible.....	212 E. 3d Street.....	1.024	83	89.49	10.51
A. Reichert.....	152 E. 3d Street.....	1.021	73	90.78	9.22
J. Lang.....	5 Clinton Street.....	1.024	83	89.53	10.47
Average.....		1.0208	72.45	89.89	10.11

*Third Series of Analyses.*—During the last four months of the year, a series of more elaborate analyses was undertaken, with a view to determine the percentages of some of the individual constituents of the milk. Thirty-five samples were examined, and the results, which are herewith presented in tabular form, establish the fact that—

1. The cream averaged 7.89 per cent., ranging from 5.20 to 11.80 per cent.
2. The percentage of pure milk, as shown by the galactometer, averaged 82.44, varying from 50 to 112.
3. The butter averaged 3.03 per cent., varying from 1.81 to 3.76.
4. The casein and milk-sugar together averaged 6.46 per cent., ranging from 4.16 to 9.02.
5. The saline and earthy constituents averaged 0.59 per cent., varying from 0.39 to 0.87 per cent.
6. The total solids averaged 10.08 per cent., ranging from 6.73 to 12.32 per cent.
7. The water averaged 89.92 per cent., ranging from 87.68 to 93.27 per cent.
8. No adulteration was found in any case save water.

Table II.—Milk Examinations during the last Four Months of 1869.

DATE.	DEALER.	ADDRESS.	Reaction.	Cream.	Percentage of Milk by Galactometer.	Butter.	Casein and Sugar.	Salts.	Total Solids.	Water.
September 22	Thid.	30 Avenue A.	.....	.....	62	2.68	6.12	0.57	9.37	90.63
" 22	Roth.	81 Avenue A.	.....	.....	73	2.25	5.87	0.53	8.65	91.35
" 22	Dorsch.	122 E. 7th Street.	.....	.....	64	2.02	4.91	0.57	8.10	91.90
" 22	A. Ritter.	223 Houston.	.....	.....	66	2.09	5.74	0.53	8.36	91.64
" 23	Taylor's Saloon.	Rockland Conny	.....	8.5	80	3.25	6.32	0.65	10.22	89.78
" 24	C.A. Kelley	355 Broadway	.....	8.5	112	2.43	9.02	0.87	12.32	87.68
" 27	Riesse Bros.	105 Avenue C.	.....	7.8	50	2.18	4.16	0.39	6.73	93.27
" 27	Barkley	69 Avenue C.	.....	7.8	68	2.67	5.57	0.51	8.75	91.25
" 27	Jon.	14 Avenue C.	.....	6.6	71	2.26	5.97	0.52	8.75	91.25
" 27	Maloney	365 2d Street.	.....	6.6	75	3.11	5.84	0.59	9.25	90.75
October 4	Busch	210 E. 6th Street.	.....	7.3	69	3.11	5.90	0.54	9.55	90.45
" 4	Lubkin	213 E. 6th Street.	.....	6.2	87	2.91	6.76	0.71	10.52	89.48
" 4	Sunken	223 Bowerly	.....	5.2	79	2.91	6.68	0.62	10.21	89.79
" 30	Jacob Stein	Mott and Spring	Neutral.	6.3	86	1.81	7.26	0.66	9.73	90.27
" 30	A. Tienken	297 Mott.	.....	6.3	86	3.76	6.34	0.65	10.75	89.25
" 30	Henry Claus Fayer.	73 E. Houston.	.....	7.8	85	2.24	7.35	0.64	10.23	89.77
November 2	A. Hadden	296 E. 24th Street.	.....	6.5	96	3.02	7.32	0.69	11.03	88.97
" 17	Michael McBride.	1944 Greene.	.....	12.8	97	3.21	6.43	0.50	10.14	89.86
" 17	Mary Felcine	209 Greene.	.....	8.3	86	3.32	7.16	0.63	11.11	88.89
" 17	Marcus Martins	197 Greene.	.....	6.1	78	3.01	6.24	0.59	9.84	90.16
" 17	Herrn Seebereck	157 Greene.	.....	8.1	70	3.54	5.76	0.54	9.84	90.16
" 27	Hermann Drewes.	225 Chrystie.	.....	8.3	100	3.69	7.49	0.67	11.85	88.15
" 27	John Whitman.	151 E. Houston.	.....	8.0	95	3.12	7.77	0.63	11.52	88.4
" 27	Albert Schmitt.	11 1st Avenue.	.....	6.1	90	2.50	7.32	0.61	10.43	89.57
" 27	John D. Schmidt.	185 E. Houston.	.....	9.8	90	2.87	8.10	0.62	11.59	88.41
December 11	William Kattenbach.	178 Essex.	.....	8.9	97	3.21	7.37	0.63	11.21	88.79
" 11	Hermann Pfing.	175 Essex.	.....	8.0	96	3.38	7.80	0.63	11.71	88.29
" 11	John Gess.	160 Essex.	.....	9.9	88	3.34	6.56	0.52	10.42	89.58
" 11	Christian Schaefer.	129 Stanton.	.....	9.9	88	3.02	6.76	0.58	10.36	89.64
" 16	Michael Reinhardt.	217 Stanton.	Acid.	8.0	89	2.62	7.17	0.62	10.41	89.59
" 16	Philip Thomas.	96 Willet.	.....	9.3	72	2.87	5.83	0.47	9.17	90.83
" 16	Jacob Weymar.	101 Willet.	.....	11.1	100	2.86	7.74	0.67	11.67	88.33
" 16	Average	118 Willet.	.....	7.89	82	2.36	6.37	0.49	9.22	90.78
.....	Average	.....	.....	7.89	82.44	3.03	6.46	0.59	10.08	89.92

*Fourth Series of Analyses.*—During the month of April, the attention of the Board having been called to the crowded condition of some of the large cow-stables in the Metropolitan District, the Sanitary Superintendent, Dr. Harris, was directed to make an investigation. It was found on examination that, although the stables were over-crowded, dark, and damp, and deficient in ventilation, the animals generally presented a good appearance.

Seven samples of milk were collected and submitted to analysis, with the following results:

	Water.	Butter.	Casein and Sugar.	Salts.
No. 1 .....	90.00	1.31	8.00	0.69
" 2 .....	89.02	2.16	8.10	0.72
" 3 .....	88.88	2.41	7.62	0.79
" 4 .....	88.18	2.54	8.50	0.78
" 5 .....	88.09	2.32	8.75	0.84
" 6 .....	88.48	1.51	9.20	0.81
" 7 .....	89.20	0.84	9.19	0.77
Average.....	88.85	1.87	8.48	0.77
Healthy Milk.....	86.00	3.90	9.30	0.80

It appears that the milk of these cows is specially deficient in butter, though it is in *every* respect poorer than the milk of healthy cows. No other indications of disease could be detected in the milk.

The blood of three of these cows was also analyzed, with the following results—the 4th column is an analysis of healthy blood:

	1.	2.	3.	4.
Water.....	799.81	801.35	843.12	779.06
Fibrin.....	4.91	5.94	7.63	4.39
Albumen.....	104.90	69.37	85.22	60.02
Corpuscles.....	81.10	101.13	51.33	146.50
Extractive .....	0.95	3.68	6.40	3.20
Soluble Salts.....	8.33	8.53	6.30	7.01
	1,000.00	1,000.00	1,000.00	1,000.00

The blood of the confined cows is strikingly deficient in red corpuscles, and contains from two to six per cent. more water than the healthy blood. It is thus seen that, while these cows present a fair appearance, they are not in a sound, healthy condition; and, though analysis may fail to detect any specific poison, such milk cannot be considered healthy food.

#### CONCLUSION.

This investigation establishes the fact that the citizens of the Metropolitan District are generally receiving milk which is free from injurious adulterations, and untainted with disease.

Nevertheless, a fraud is perpetrated upon them in the systematic dilution of the milk with water. The average percentage of pure milk in the adulterated

article with which the city is supplied, is 73.28; or, in other words, for every three quarts of pure milk there is added one quart of water. It was stated at the Convention of Milk Producers and Dealers, held at Croton Falls, in March, 1870, that the total amount of milk supplied to the cities of New York and Brooklyn from the surrounding country was about 120,000,000 quarts per annum. To reduce this to the quality of our city supply, requires an addition of 40,000,000 quarts of water, which, at ten cents per quart, costs us the snug sum of \$4,000,000 annually, or about \$12,000 per day.

I have been aided in this investigation by W. H. Chandler, M. Alsberg, Ph. D., and H. Endemann, Ph. D.

Very respectfully, yours,

C. F. CHANDLER, Ph. D.,

*Chemist to the Metropolitan Board of Health.*

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